

Emergency pediatrics

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Advanced Life Support

**PEDIATRIC ADVANCED LIFE SUPPORT
PROTOCOLS**

TABLE OF CONTENTS

Essential knowledge

Newborn Resuscitation P1

Respiratory Arrest P 2

Obstructed Airway P 3

Respiratory Distress / Failure (Croup/Epiglottitis) P 4

Non-Traumatic Cardiac Arrest P 5

Asthma/Wheezing P 6

Anaphylactic Reaction P 7

Altered Mental Status P 8

Status Eilepticus P 9

Decompensated Shock P 10

Traumatic Cardiac Arrest P 11

pediatric patients are as defined by the AHA, children without secondary signs of puberty.

A “length/weight based” dosing device should be used on all pediatric patients to assure the correct administration of medications.

Essential knowledge

Weight: (1 kg = 2.2 lb)

Infant: 0–1 years = 3–10 kg

5 months: double birth weight

12 months: triple birth weight

After 1 year: wt in kg = 2 (age + 4)

2 years: quadruple birth weight

Airway and breathing (endotracheal intubation) ↑ under 25 kg = uncuffed

Full term infant = 3.0–3.5 mm ID

Infant < 1 year = 4.0–4.5 mm ID

Child > 1 year = age/4 + 4 ID.

Length of tube =

$\left[\frac{\text{Age}}{2} \right] + 12 \text{ cm for oral tube} + 14 \text{ cm for nasal tube}$

Circulation (dehydration treatment: deficit in

ml = (% dehydration * weight in kg * 10)

Blood pressure systolic = 80 + (age year * 2) Cuff

must be two-thirds size of upper arm and the largest that will fit

Capillary refill = 2 seconds or less after 5 seconds pressure(sternum)

Drip rates for clear fluids: (standard giving set)

20 drops = 1 ml ml/h divided by 3 = drops/min

Minimum urine output: > 1 ml/kg/h in children, > 2 ml/kg/h in infants

Insensible losses: 300 ml/m²/24 h or

12 ml/kg/24 h if > 1 year

15 ml/kg/24 h if an infant

24 ml/kg/24 h if preterm

increased if in hot climate by around 50%

increased if fever by 50%

Fluid management

Blood volume is 100 ml/kg at birth falling to 80 ml/kg at

1 year. Total body water varies from 800 ml/kg in the neonate

to 600 ml/kg at one year and thereafter. Of this about two

thirds (400 ml/kg) is intracellular. Clinically, dehydration is not detectable until >5% (50 ml/kg).

Fluid requirements:

1. Replace *insensible losses* through sweat, respiration, gastrointestinal loss etc.
2. Replace of *essential urine output*, the minimal urine output to allow excretion of the products of metabolism etc.
3. Extra fluid to maintain a *modest state of diuresis*.
4. Fluid to replace *abnormal losses* such as blood loss, severe diarrhoea, diabetic polyuria losses etc.

Normal fluid requirements

Fluid requirement Fluid requirement

Body weight	Fluid requirement per day	Fluid requirement per hour
First 10 kg	100 ml/kg	4 ml/kg
Second 10 kg	50 ml/kg	2 ml/kg
Subsequent kg	20 ml/kg	1 ml/kg

Examples: 6 kg infant would require 600 ml per day

14 kg child would require $1000 + 200 = 1200$ ml per day

25 kg child would require $1000 + 500 + 100 = 1600$ ml per day.

Electrolyte contents of body fluids

Fluid	Na (mmol/l)	K (mmol/l)	Cl (mmol/l)	HCO ₃ (mmol/l)
Plasma	135–141	3.5–5.5	100–105	24–28
Gastric	20–80	5–20	100–150	0
Intestinal	100–140	5–15	90–130	15–65
Diarrhoea	7–96	34–150	17–164	0–75
Sweat	<40	6–15	<40	0–10

*Normal water, electrolyte, energy and protein requirements
(provided excessive loss is not present)*

Body weight	Water (ml/kg/day)	Sodium (mmol/kg/day)	Potassium (mmol/kg/day)	Energy (kcal/day)	Protein (g/day)
First 10 kg	100	2–4	1.5–2.5	110	3.00
Second 10 kg	50	1–2	0.5–1.5	75	1.50
Subsequent kg	20	0.5–1.0	0.2–0.7	30	0.75

Essential drug doses

Aminophylline: IV loading dose 5 mg/kg over 20 minutes

(max = 250 mg) then 1 mg/kg/h by IV infusion

Benzyl penicillin: 50 mg/kg IV 4–6 hourly

Cefotaxime: IV 50 mg/kg 6 hourly

Diazepam IV or IO 100–250 micrograms/kg or rectal 500 micrograms/kg (max = 10 mg)

Lorazepam IV or IO 50–100 micrograms/kg

Paraldehyde rectal or IM 0.4 ml/kg (max 10 ml rectal, 5 ml IM at one site)

Epinephrine (adrenaline): 10 micrograms/kg

(0.1 ml/kg 1 in 10 000 or 0.01 ml/kg of 1 in 1000)

Epinephrine: 1 in 1000 = 1 mg/ml: 1 in 10 000 = 100 micrograms/ml

Fluid resuscitation: 20 ml/kg 0· 9% saline or colloid or blood(10 ml/kg in neonate)

Frusemide: 1 mg/kg IV

Glucose: 5 ml/kg of 10% IV (0.5 g/kg)

Mannitol: 250–500 mg/kg IV over 20 minutes

Morphine: IV 100 micrograms/kg over 5 minutes (50–100 micrograms/kg in the neonate)

Salbutamol: 100–1000 micrograms inhaler (1–10 sprays) or nebuliser (dose 2· 5 mg < 5 years and 5 mg > 5 years)

Salbutamol: IV loading dose = 4–6 micrograms/kg over 15 minutes monitor ECG and ensure K⁺ normal

Sodium bicarbonate: 1 mmol/kg (= 2 ml/kg of 4· 2%).

Disability

Assessment of neurological function (AVPU)
(modified Glasgow Coma Scale)

A = alert, V = responds to voice, P = responds to pain,
U =unresponsive.

Pupillary size and reaction, posture, muscle tone,
presence of convulsive movements.

Normal values for paediatric vital signs in patients
who are not crying

Age	Heart rate	Systolic blood pressure	Respiratory rate
< 1 year	120–140	70–90	30–40
2–5 years	100–120	80–90	20–30
5–12 years	80–100	90–110	15–20

Pediatric ALS Protocols

NEWBORN RESUSCITATION

Protocol P1

Suction immediately after birth ONLY if there is an obvious obstruction to spontaneous breathing or positive-pressure ventilation is necessary.

Standing Orders

- o BLS Newborn Resuscitation procedures.
- o If newborn is depressed and meconium staining is present, delay drying and stimulation.

Suction airway before taking other resuscitative measures.

- o Begin Newborn Resuscitation procedures only after the airway has been cleared of thick meconium, as follows:

- . Perform endotracheal intubation and directly suction the endotracheal tube via a meconium aspirator/adaptor while slowly withdrawing the endotracheal tube.

Note: Do not exceed 100-mmHg suction vacuum

- . Repeat this procedure until little or no meconium is acquired or until the heart rate indicates resuscitation must begin immediately.

- . Do not replace the endotracheal tube once the airway has been cleared of thick meconium unless the newborn remains limp, apneic, or pulseless.

For all newborns requiring resuscitation once BLS

Newborn Resuscitation procedures have begun:

During transport, or if transport is delayed:

- o If the newborn appears to be in respiratory distress and the heart rate is below 120 BPM, administer oxygen in as high a concentration as possible.

- o If the newborn appears to be in respiratory distress and the heart rate is below 100 BPM, ventilate via BVM or mouth-to-mask with oxygen attached.

- o If the newborn appears to be in respiratory distress and the heart rate is below 60 BPM, ventilate via BVM or mouth to mask, begin CPR, administer:

- o Epinephrine 1:10,000 0.01 mg/kg via IV / IO

MEDICAL CONTROL OPTIONS

- o Repeat Epinephrine every 3-5 minutes

- o Endotracheal Intubation

- o Epinephrine 1:1000 0.1 mg/kg via Endotracheal tube

- o Check for Blood Glucose - if < 60 mg/dl - Dextrose D10 IV / IO - (0.5 gm/kg)

- o IV / IO infusion of Normal Saline (0.9% NaCl) 10 ml/kg. Reassess & document after each bolus. Attempt IV or IO only once each.

Pediatric ALS Protocols

PEDIATRIC RESPIRATORY ARREST

Protocol P2

For pediatric patients in actual or impending respiratory arrest, or who are unconscious and cannot be adequately ventilated:

Standing Orders

- o Open airway and begin ventilation as per BLS Pediatric Respiratory Distress/Failure procedures. If narcotic overdose is suspected, refer AMS protocol (P8)
- o If an obstructed airway is suspected, refer obstructed airway protocol. (P3)
- o Perform endotracheal intubation if BLS measures are not adequate.

Consider a supraglottic airway

- o I.V. of Normal Saline (0.9% NaCl) KVO or a saline lock
During transport or if transport is delayed

- o Administer Naloxone,
Patients . 2 years old - titrate in increments of 0.1mg/kg-
until effective (max 2 mg)

Patients < 2 years old - titrate to (max 1 mg)

MEDICAL CONTROL OPTIONS:

- o IO infusion of Normal Saline (0.9% NaCl).
- o Naloxone IV/ IO / ET / IN / IM as directed.
(No more than 2 attempts at vascular access)

Paramedic - If a tension pneumothorax is suspected consider orders to perform needle decompression, using an 18-20 gauge catheter

Pediatric ALS Protocols

PEDIATRIC OBSTRUCTED AIRWAY

Protocol P3

For pediatric patients who are unconscious or present with signs & symptoms of inadequate air exchange:

Standing Orders

- o Begin BLS Pediatric Obstructed Airway procedures.
- o Perform direct laryngoscopy - attempt to remove the foreign body with appropriate size Magill Forceps.

NOTE:

IF AN ENLARGED EPIGLOTTIS IS VISUALIZED - DO NOT ATTEMPT ENDOTRACHEAL INTUBATION.

USE BAG-VALVE-MASK (w/ pop-off disabled)

- o Perform endotracheal intubation, if BLS measures are not adequate.

Consider a supraglottic airway

If unable to ventilate despite confirmed intubation by direct visualization:

- . Note the endotracheal tube depth
- . Deflate cuff (if cuffed tube is used)
- . Advance tube to its deepest depth - and return to original depth
- . Re-inflate tube cuff and attempt ventilation
- . If unable to ventilate effectively - immediately initiate transport

MEDICAL CONTROL OPTIONS:

Paramedic - If a tension pneumothorax is suspected consider orders to perform needle decompression, using an 18-20 gauge catheter

Pediatric ALS Protocols

PEDIATRIC RESPIRATORY DISTRESS or Suspected Croup / Epiglottitis

Protocol P4

Standing Orders

- o Begin BLS Pediatric Respiratory Distress / Failure procedures.

- o If child is alert and oriented, transport in position of comfort with parent.

- Offer cool mist 100% Oxygen if child will allow.

- o If child presents with signs & symptoms of inadequate air exchange, refer to protocol (P3)

**NOTE: DO NOT ATTEMPT ENDOTRACHEAL
INTUBATION. USE BAG-VALVE-MASK**

MEDICAL CONTROL OPTIONS:

- o Racemic Epinephrine, 0.05 mg/kg in 3cc 0.9% saline (Max. 5 ml) via Nebulizer

- (if unavailable, Epinephrine may be used at the 2mL in 3mLsaline)

- o Consider Endotracheal Intubation in acute epiglottitis with an ET tube one mm smaller than calculated.

- o Dexamethasone (Decadron) 0.6 mg/kg IV / IO

- o Methylprednisolone (Solu-Medrol) 2 mg/kg IV / IO (max 60 mg)

Paramedic - If child is in respiratory arrest, perform needle cricothyrotomy.

Pediatric ALS Protocols

NON-TRAUMATIC CARDIAC ARREST

Protocol P5

Standing Orders

- o Begin BLS Pediatric Cardiac Arrest procedures. Initiate CPR

Perform endotracheal intubation, if BLS airway measures are not adequate.

- o Cardiac Monitoring.

- . If in ventricular fibrillation or pulseless ventricular tachycardia, immediately defibrillate

- at 2 joules/kg. Resume CPR immediately. - (2 min.)

- . If still in ventricular fibrillation or pulseless ventricular tachycardia, immediately repeat

- defibrillation at 4 joules/kg. Resume CPR immediately - (2 min.)

- . Epinephrine 1:10,000 0.01 mg/kg via IV or IO (Repeat every 3-5 minutes)

- OR Epinephrine 1:1,000 0.1 mg/kg via ET (only if no IV/IO) (Repeat every 3-5 minutes)

- . If still in ventricular fibrillation or pulseless ventricular tachycardia, immediately repeat defibrillation at 4 joules/kg. Resume CPR immediately - (2 min.)

- o Begin transport

- o IV or IO infusion of Normal Saline (0.9% NaCl) KVO.

- o Contact Medical Control for additional medication orders.

MEDICAL CONTROL OPTIONS:

- . Increase energy settings up to 10 joules / Kg

- . Amiodarone 5mg/kg IV/ IO if V-Tach or V-Fib (max.300mg)

OR

- . Lidocaine 1 mg/kg rapid IV/IO push if Amiodarone is not available.
- . Dextrose D10 IV / IO - (0.5 gm/kg)
- . Sodium Bicarbonate 1 mEq/Kg IV/IO/saline lock.
- . Magnesium Sulfate 25-50 mg/kg (max. 2g) - for Torsades

Pediatric ALS

Protocols

PEDIATRIC ASTHMA/WHEEZING

Protocol P6

For pediatric patients with acute asthma and/or active wheezing:

Standing Orders

- o Begin BLS Pediatric Respiratory Distress/Failure procedures.

- o Administer Albuterol Sulfate 0.083% -one unit dose of 3 ml - via nebulizer.

patients < 6 months - ½ unit dose

If no response, 2nd unit dose to follow immediately.

If still no response, contact medical control immediately.

- o Administer Ipratropium Bromide 0.02% (one unit dose of 2.5 ml for children . 6 years)

(1/2 unit dose of 2.5 ml for children under 6), via nebulizer in conjunction with each

Albuterol Sulfate dose.

Patients . 1 year, with severe respiratory distress, respiratory failure, and/or decreased breath sounds

- o Epinephrine 1:1000 0.01 mg/kg IM (max. 0.3 mg)

- o Intubation

- o Consider IV/IO and rapid transport - if Patient unstable.

MEDICAL CONTROL OPTIONS:

- o IV infusion of Normal Saline (0.9% NaCl) KVO, IV/ IO

- o Repeat Albuterol Sulfate via nebulizer.

- o Repeat Ipratropium Bromide 0.02% by nebulizer.

- o Repeat Epinephrine 1:1,000 0.01 mg/kg IM (max 0.3 mg)

- o Methylprednisolone (Solu-Medrol) 2 mg/kg IV/IO (max 60 mg)

Pediatric ALS Protocols

PEDIATRIC ANAPHYLACTIC REACTION

Protocol P7

Standing Orders

- o Begin BLS Anaphylactic Reaction procedures.
- o Epinephrine 1:1000 0.01 mg/kg IM (max. 0.3 mg)
or
- o Epinephrine Autoinjector JR. 0.15 mg IM
- o Administer Albuterol Sulfate 0.083% one unit dose of 3 ml - via nebulizer. - if wheezing patients < 6 months - ½ unit dose

If patient develops signs of respiratory failure or airway obstruction:

- o Endotracheal intubation
- o Initiate rapid transport.

paramedic

- o Diphenhydramine 1mg/kg IV/ IO / IM

During transport, or if transport is delayed:

- o IV infusion of Normal Saline (0.9% NaCl) via a large bore IV (18-22 gauge) to keep the vein open, or a saline lock.
- o IF PATIENT IS IN ANAPHYLACTIC SHOCK and IV cannot be established, IO infusion of Normal Saline (0.9% NaCl) at KVO rate.

MEDICAL CONTROL OPTIONS:

- o Repeat any of the above standing orders.
- o Begin rapid IV or IO infusion of Normal Saline (0.9% NaCl), 20 ml/kg. Repeat as necessary.
 - o Methylprednisolone (Solu-Medrol) 2 mg/kg IV/IO (max 60 mg)

Pediatric ALS Protocols

PEDIATRIC ALTERED MENTAL STATUS

Protocol P8

For pediatric patients in coma, with evolving neurological deficit, or with altered mental status of unknown etiology:

NOTE: MAINTENANCE OF NORMAL RESPIRATORY AND CIRCULATORY FUNCTION IS ALWAYS THE FIRST PRIORITY. PATIENTS WITH ALTERED MENTAL STATUS DUE TO RESPIRATORY FAILURE OR ARREST, OBSTRUCTED AIRWAY, SHOCK, TRAUMA, NEAR DROWNING OR OTHER ANOXIC INJURY SHOULD BE TREATED UNDER OTHER PROTOCOLS.

Standing Orders

- o Assess respiratory and circulatory status.
 - o Begin BLS Altered Mental Status procedures.
 - o IV of Normal Saline (0.9% NaCl) KVO, or a saline lock.
- Attempt IV only once.

Perform a glucometer test for blood sugar level. If less than 60 mg/dL administer dextrose or glucagon and continue to monitor as needed after administration.

- o Dextrose D10 IV / IO - (0.5 gm/kg)

OR

- o Glucagon 0.1 mg/kg IM (if no IV established).

MEDICAL CONTROL OPTIONS:

- o Repeat any of the above orders.
- o IO infusion of Normal Saline (0.9% NaCl).
- o Naloxone 0.1mg/kg IV / IO / IM / IN - if there is no change in mental status
- o Transport to a Pediatric specialty receiving facility

Pediatric ALS Protocols

PEDIATRIC STATUS EPILEPTICUS

Protocol P9

For pediatric patients in Status Epilepticus:

Standing Orders

- o Begin BLS Seizures procedure - cardiac monitor, pulse oximetry, waveform capnography.

Perform a glucometer test for blood sugar level. If ≥ 60 mg/dL:

- o IV / IO infusion of Normal Saline (0.9% NaCl) KVO
- o Dextrose D10 IV / IO - (0.5 gm/kg)

OR

- o Glucagon 0.1 mg/kg IM (if no IV established).

Paramedic

If patient is still seizing or blood sugar is normal:

- o Midazolam 0.2 mg/kg IM / IN (max. 5 mg) Note: IN route is preferred

If seizures persist - contact Medical control of options.

MEDICAL CONTROL OPTIONS:

- o IO infusion of Normal Saline (0.9% NaCl).
- o Midazolam 0.2 mg/kg IM / IN (max. 5 mg) - Note: IN route is preferred
- o Lorazepam 0.05 mg/kg IV/ IN/ IO (slowly over 2 minutes)

Repeat doses may be given if seizures persist

- o Diazepam 0.1 mg/kg IV/ IO (slowly over 2 minutes)

Repeat doses may be given if seizures persist

If NO IV / IO:

- o Repeat Midazolam 0.2 mg/kg IM / IN (max. 5 mg)
- o Diazepam 0.1 mg/kg per rectum

NOTE: DO NOT ADMINISTER DIAZEPAM or
MIDAZOLAM IF THE SEIZURES HAVE STOPPED.
FLUSH IV LINE BETWEEN GLUCOSE AND
DIAZEPAM or MIDAZOLAM

Pediatric ALS Protocols

PEDIATRIC DECOMPENSATED SHOCK

Protocol P10

Standing Orders

- o Begin BLS Pediatric Shock procedures.
- o If signs of hemorrhage or dehydration are not present, begin Cardiac Monitoring.

If adrenal cortical insufficiency (Addison's) / hyperplasia is confirmed *

- o Hydrocortisone Sodium Succinate (Solu-Cortef) 2mg/kg IV/IO (max.100mg)

NOTE: FOR PATIENTS IN SUPRAVENTRICULAR TACHYCARDIA OR VENTRICULAR TACHYCARDIA WITH A PULSE, AND WITH EVIDENCE OF LOW CARDIAC OUTPUT, CONTACT MEDICAL CONTROL FOR OPTIONS.

During transport, or if transport is delayed:

- o Begin rapid IV Bolus of Normal Saline (0.9% NaCl) 20 ml/kg, via a large-bore IV (18-22 gauge) or IO catheter. Attempt IV or IO only once each.
- o If signs of hemorrhage or dehydration are present, and the patient remains in decompensated shock, begin second large bore IV and repeat bolus up to an additional 20 ml/kg (total of 40 ml/kg), Attempt second IV only once.

MEDICAL CONTROL OPTIONS:

- . Begin IO infusion
- . Continue rapid IV or IO bolus of Normal Saline (0.9% NaCl) up to an additional 20 ml/kg (total of 60 ml/kg).
- . Hydrocortisone Sodium Succinate (Solu-Cortef) 2mg/kg IV/IO (max.100mg)

. If transport is delayed or extended, and the patient presents with:

1. Supraventricular tachycardia or ventricular tachycardia with a pulse, with evidence of low cardiac output, perform synchronized cardioversion at 0.5-1 joules/kg, using pediatric pads. If necessary, repeat at 1-2 joules/kg.
2. Supraventricular tachycardia with evidence of low cardiac output, if the Defibrillator is not able to deliver a calculated dose, administer Adenosine 0.1 mg/kg, rapid IV or IO bolus (not to exceed 6 mg), followed immediately by 5-10 ml of Normal Saline (0.9% NaCl) flush. If necessary, Adenosine may be repeated at 0.2 mg/kg, rapid IV or IO bolus (not to exceed 12 mg), followed immediately by 5-10 ml Normal Saline (0.9% NaCl) flush.

Pediatric ALS Protocols

PEDIATRIC TRAUMATIC CARDIAC ARREST

Protocol P11

Standing Orders:

- o Initiate BLS stabilization procedures
- o Perform ETI - if BLS measures not adequate (use caution with possible C-spine injury)
- o Begin rapid transport
- o Establish IV or IO access, administer bolus Normal Saline (0.9% NaCl) - 20 ml/kg
- o Monitor ECG
- o If continued signs of inadequate perfusion persist repeat a second IV bolus of 20 ml/kg (total of 40 ml/kg)

Medical Control Options:

- o Continue Normal Saline (0.9% NaCl) up to an additional 20 ml/kg (total of 60 ml/kg).
- o Hospital Diversion
- o Epinephrine 1:10,000 0.01 mg/kg IV/IO

Paramedic - If a tension pneumothorax is suspected consider orders to perform needle decompression, using an 18-20 gauge catheter

References

1-pocket emergency pediatric care

2

**Nassau Regional
Emergency Medical Services**